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ABSTRACT

This bulletin of the Schools Council (London, England) lists and describes curriculum research and development projects in science developed in England from 1963 to the present. The projects described in this paper range from those encouraging a wide-ranging, interest-centered curriculum to those for older pupils with a clearly structured approach. Others are based more on topic work. Through all there is an emphasis on relevance of work to the pupils and a need to give pupils an experience of genuine discovery. This list also contains projects that cover the conceptual areas of several traditional subjects--particularly in relation to a study of the environment either looking for educational opportunities based on a study of the environment or devising studies leading to an understanding of man's place in the environment and his use of it. Further details of all projects are given in Schools Council Project Profiles and Index, available from the Information Section, Schools Council. (BT)

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curriculum research and development in science

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Major large-scale curriculum studies in science began in this country when the Nuffield Foundation financed the development of courses in biology, chemistry and physics for the O-level of the General Certificate of Education and the A-level in biology, chemistry, physics and physical science.

Since 1963 development studies have expanded and have now been continued by further work financed by the Schools Council.

The age range covered by the projects is 5–18 and almost the whole ability range is catered for. This is especially important for the many comprehensive schools of different types in England and Wales and also in view of the new kinds of schools such as middle schools or sixth-form colleges that have appeared since 1965.

The middle schools, most of which have an age range of 8–12 or 9–13, have given expression to the need felt by many teachers to bring fresh ideas to bear on the kinds of curriculum best suited to children aged 8–13 whose individual development within a group of a given age may vary enormously.

The projects described in this paper range from those encouraging a wide-ranging, interest-centred curriculum to those for older pupils with a clearly structured approach. Others are based more on topic work. Through all there is an emphasis on relevance of work to the pupils and a need to give pupils a 'hands-on' experience of genuine discovery.

Behind all this work lie continuing attempts to define better the nature of the scientific process in education through encouraging children to think, to look for patterns, to use these patterns to solve problems and at the same time to take account of science as a force within society by relating their knowledge of science and their scientific thinking to everyday experience.

This list also contains projects that cover the conceptual areas of several traditional subjects – particularly in relation to a study of the environment either looking for educational opportunities based on a study of the environment or devising studies leading to an understanding of man's place in the environment and his use of it.

Similar to these environmental studies are those relating to technology and creative design. Yet other projects in integrated or general studies require some knowledge of science on the part of teachers who wish to use these materials.

The use of these project materials in schools is based on the decision of teachers in the local situation. Many groups of teachers, often in conjunction with the activities of teachers' centres, are continuing the process of curriculum design in their own schools. This change is also beginning to focus attention on the information problems implied by the wide spread of curricular development described in this pamphlet.

RESEARCH AND DEVELOPMENT PROJECTS

Further details of all projects are given in *Schools Council Project Profiles and Index,* available at £1 including postage (£1.20 overseas) from Information Section, Schools Council. Information on individual projects is available from the Council's Project Information Centre.

Science 5–13

A project to assist teachers to help children to gain experience and understanding of the environment, and to develop their powers of thinking effectively about it. This has been done through the identification and development of topics or areas of science related to a framework of concepts appropriate to the pupils' intellectual development. Twenty-one teachers' guides have been published by Macdonald Educational and *Science 5–13: a formative evaluation* by Wynne Harlen was published by Macmillan Education in 1975. A series of source books, USING THE ENVIRONMENT, by Dr Margaret Collis have also been published by Macdonald Educational.

5–13 years 1967–74

Len F. Ennever, School of Education, University of Bristol, 19 Berkeley Square, Bristol BS8 1HF

Progress in Learning Science

The project aims to produce a check list of statements to help teachers recognize and record the level of development of their children, a guide to indicate kinds of scientific activities appropriate for children at various levels of development, and a handbook describing the production and validation of the check list. A newsletter is available free from the project.

5–13 years 1973–76

Dr Wynne Harlen, School of Education, University of Reading, London Road, Reading RG1 5AQ

Science and Mathematics in Welsh Medium Schools

A project aimed to encourage an investigatory approach in the learning of science and mathematics through the medium of Welsh in children up to 12 years. Two teachers' guides

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and sixty pupils' booklets are being published by English Universities Press, from 1974.

5–12 years 1969–72

Merfyn Griffiths, Faculty of Education, Cambrian Place, University College, Aberystwyth

Educational Use of Living Organisms

Research to determine the needs of schools with respect to living organisms and the associated educational, administrative and biological problems; to identify and evaluate the usefulness of different species in teaching; to devise culture and maintenance techniques and teaching procedures for the effective use of the most appropriate species; to provide information on these matters through pamphlets, charts and other visual material.

A series of booklets on the use of living organisms, wall charts, visual aids and a source book have been prepared and are being published by English Universities Press from 1974. *Recommended Practice for Schools Relating to the Use of Living Organisms and Material of Living Origin* was published early in 1974.

5–18 years 1969–72

P. J. Kelly, Centre for Science Education, Chelsea College, University of London, Bridges Place, London SW6 4HR

Environmental Studies

The project was established to help teachers use the environment systematically to provide experiences that help the progressive development of the child's skills and concepts throughout his primary career and beyond. Four teachers' guides published by Rupert Hart Davis (1972–73): *Starting from Maps, Case Studies, Teachers Guide,* and *Starting from Rocks. Environmental Studies Project (5–13): an evaluation* by R. W. Crossland and S. F. D. Moore will be published by Macmillan Education, late 1974. A 16 mm film, *Environmental Studies 5–13,* is available for sale or hire from the National Audio Visual Aids Library, Paxton Place, Gipsy Road, London SE27 9SR.

5–13 years 1967–71

Melville Harris, Cartrefle College of Education, Wrexham, Denbighshire

The Development of Scientific and Mathematical Concepts

A project to construct tests to study the development of scientific and mathematical concepts in children between the ages of 7 and 12 and to attempt to relate this development to the maturation of the pupil and ability. A research report will be published by Macmillan Education. Concept assessment kits for volume, area and weight will be published by Taskmaster Ltd in March 1975. A handbook for teachers will be published by Thomas Nelson Ltd from 1975.

7–11 years 1968–73

Dr J. Rogers, University College of North Wales, Bangor

Project Environment

The project has attempted to build on the present tradition in schools of encouraging pupils to care for living things and to develop a sense of responsibility for them. It aimed to help teachers widen the work to involve studies of the school environment and to foster an interest in the quality of the environment and a concern for its intelligent management.

Materials for teachers are being published by Longman: *Education for the Environment,* 1974; *Learning from Trails* and *School Outdoor Resource Areas,* early 1975; two further titles later in 1975.

8–18 years 1970–73

R. W. Colton, Department of Education, University of Newcastle upon Tyne, St. Thomas' Street, Newcastle upon Tyne NE1 7RU

Project Technology

Project Technology aimed to promote a full understanding by boys and girls in school of the importance and relevance of technology, and to develop pupils' creative abilities through direct experience in technological activities. The project aimed thereby to help pupils to understand the role of technology in society and the application of scientific knowledge to practical problems.

It was not intended to design a complete course in technology, but rather to develop teaching materials and to stimulate outside support of all kinds.

Evaluation of the work has been carried out by D. A. Tawney and S. E. Gunn, under the direction of Professor S. J. Eggleston, at the University of Keele.

Publication as follows:

PROJECT TECHNOLOGY HANDBOOKS (first fourteen titles available), TECHNOLOGY BRIEFS – Heinemann Educational Books from 1972. CSE course material and review materials as well as A-level course elements – English Universities Press, 1975.

11–18 years 1967–72

G. B. Harrison, Loughborough College of Education, Loughborough LE11 0BR (Geoffrey Harrison is now at Trent Polytechnic.)

Nuffield Combined Science

This project has provided materials for a combined science course for pupils aged about 11 to 13, complete in itself and suitable as a lead into subsequent science courses including O-level courses (Nuffield or other), the Nuffield Secondary Science Course, and CSE work.

A short continuation project has considered the use of combined science materials in middle schools.

Published by Longman and Penguin Education, 1970. For the pupil: two activity packs. For the teacher: three teachers' guides, nineteen film loops.

11–13 years 1965–69

M. J. Elwell, formerly of City of Birmingham College of Education, Westbourne Road, Birmingham B15 3TN

Integrated Science

A project to develop a science course of double O-level value covering the normal range of science subjects and of a sufficient standard to provide a satisfactory basis for all existing A-level science courses. The scheme is based on three useful scientific ideas: building blocks, interactions, and energy. Throughout the three years there is a continuous search for patterns and an emphasis on the social implications of the subjects.

Published by Longman and Penguin from 1973 as PATTERNS. There will be four pupils' manuals, four teachers' guides, a teachers' handbook, a number of background books and four technicians' manuals.

13–16 years 1969–76

Co-directors W. Hall and B. Mowl; Co-ordinator, M. Lyth, Chelsea College, University of London, Bridges Place, London SW6 4AR

Nuffield Secondary Science

This project, supported by the Nuffield Foundation, has developed materials for an integrated science course for pupils aged 13–16 years who are unlikely to take the O-level examination in science.

Financial support from the Schools Council has provided for evaluation work and a supplementary study to provide guidance to teachers on Mode III CSE examinations for pupils following courses using the materials developed by the project.

Published by Longman, 1971. A teachers' guide, eight theme books, background readers, film loops and film strips. *Nuffield Secondary Science: an Evaluation* was published by Macmillan Education in 1974.

13–16 years 1965–70

Mrs H. Misselbrook, Centre for Science Education, Chelsea College, University of London, Bridges Place, London SW6 7SS

Design and Craft Education

This project has been working towards a design process or other problem-solving approach where the traditional emphasis of doing and making in school workshops and studies is joined by a parallel emphasis on thinking. Materials for teachers and pupils have been developed in five main areas: materials discovery and design, materials and domestic life, materials and community development, materials and work, and materials and leisure. These are published by Edward Arnold from autumn 1974. The feasibility study from which this project developed is published as Working Paper 26 *Education through the use of materials: the possible role of school workshops in the education of secondary school pupils* (1969). A 16 mm colour film, *Design with a Purpose,* illustrating the project's approach is available from the National Audio Visual Aids Library, Paxton Place, Gipsy Road, London SE27 9SR.

13–16 years 1968–73

Professor S. J. Eggleston, University of Keele, Department of Education, Keele ST5 5BG

'Attitudes to Science' Scales
This project developed scales for measuring attitudes towards science and to relate scores on these scales to certain relevant variables such as CSE and GCE grades as well as sex of the pupil.

Attitude scales, answer key, manual published by NFER, 1971.

14–16 years 1966–69

Dr L. Skurnik (formerly at the National Foundation for Education Research, The Mere, Upton Park, Slough, Bucks)

Evaluation of Science Teaching Methods
A study to classify teachers according to their preferred teaching style and to evaluate the effectiveness of each style by measuring pupils' scores on attainment and attitude tests.

Science Teaching Observation Schedule is to be published by Macmillan Education in 1975. Final report in preparation.

Three associated video tapes will also be for hire from Publications Section, Schools Council.

14–16 years 1970–73

Professor J. F. Kerr and J. F. Eggleston, School of Education, University of Leicester, 21 University Road, Leicester LE1 7RF

Measurement of Understanding of Pupils in Learning Science
The set of test materials produced by the project could be used for comparing the outcomes of different teaching methods in O-level science. The tests have been used by the Evaluation of Science Teaching Methods Project. Publication under discussion.

14–16 years 1966–69

Professor F. W. Wagner, Institute of Education, University of Southampton, SO9 5NH

Computers in the Curriculum
A project to discover how the use of a computer could help in the teaching of particular topics in a number of subjects other than mathematics. Physics, biology, chemistry, geography and social studies will be among the subjects examined.

Eight project papers are available free from the project.

14–18 years 1973–76

R. E. J. Lewis, Centre for Science Education, Chelsea College, University of London, Bridges Place, London SW6 4HR

General Studies
The project aims to help schools and colleges improve the quality of the general or liberal studies areas of education of students over the age of 15. With the help of associated teachers, a resources bank of over 6000 items has been built up and methods of storage and retrieval developed.

Materials are published on a subscription basis by Penguin Education and Longman (from 1972).

15–18 years 1968–74

Robert Irvine Smith, The King's Manor, University of York, York YO1 2EW

Nuffield A-level Biological Science
Materials for four units of work have been produced and evaluated. They are *Maintenance of the Organism, Organisms and Populations. The Developing Organism* and *Control and Co-ordination in Organisms.* In these, applied and pure biology are closely related and some topics of physical science and mathematics are introduced in a biological context. The scheme also includes project work, and complementary examination and assessment techniques have been devised.

Published by Penguin Education, 1971. For students: four laboratory guides, one study guide, thirteen topic reviews. For the teacher: three teachers' guides, one laboratory book, one project book and six film loops.

16–18 years 1965–70

P. J. Kelly, Centre for Science Education, Chelsea College, University of London, Bridges Place, London SW6 4HR

Nuffield A-level Chemistry
This project has prepared a two-year course, modern in content, experimental in basis, that integrates as fully as possible the various aspects of the subject. It is based on nineteen topics, to be followed by all students, together with one special study to be selected by each student from five possible alternatives.

Published by Penguin Education, 1971. For the student: two students' books, five special studies, experimental sheets, programmed texts. For the teacher: three teacher's guides, master diagrams for preparation of overhead projector transparencies, 8 mm film loops and sheets of experimental instructions.

16–18 years 1965–69

E. H. Coulson, Centre for Science Education, Chelsea College, University of London, Bridges Place, London SW6 4HR

Nuffield A-level Physical Science
This project has developed an integrated A-level course in physical science in co-ordination with the Nuffield A-level Physics and Chemistry Projects. Development work has included the devising of experiments and apparatus. An A-level pass is being accepted as an entry qualification in place of physics and/or chemistry by all university departments that normally require such passes.

Published by Penguin Education, 1973. For the student: workbook, sourcebook, introductory guide, book of data. For the teacher: two teachers' guides, overhead projection originals, film loops.

16–18 years 1965–69

Dr J. E. Spice, Centre for Science Education, Chelsea College, University of London, Bridges Place, London SW6 4HR

Nuffield A-level Physics
This two-year course attempts to emphasize the relevance and interaction of different types of thinking in physics, the importance of thoughtful experimenting by pupils working both in groups and individually, and the relevance of the ideas and results of physics to society and to everyday life.

The Schools Council's support was for evaluation work.

Published by Penguin Education, 1972. For the student: eight guides. For the teacher: eight guides, teachers' handbook, film loops.

16–18 years 1966–71

Dr P. J. Black and J. M. Ogborn, Centre for Science Education, Chelsea College, University of London, 90 Lillie Road, London SW6 7SS.

Note: The Nuffield O-level Physics, Chemistry and Biology Projects were revised during 1972–73.

Engineering Science
The Sixth-Form Engineering Science Development Unit at Loughborough, supported jointly by the university and the Council, was set up following the successful development of an A-level syllabus and examination by the Northern Universities Joint Matriculation Board.

The unit has produced teachers' guidance material and pupils' texts together with resource material to aid the development of problem-centred teaching. The materials are intended to reflect the ways of thought and creative purpose of engineering by integrating its scientific bases with the essential social and economic factors that form technology.

Teachers' guides, a students' guide and ten students' texts were published by Macmillan from 1974.

16–18 years 1970–76

Professor L. M. Cantor, Department of Education, Loughborough University, Loughborough, Leicester LE11 3TU

Investigation into the Operation of the Nuffield A-level Chemistry Examination
The research monitored attainment of the objectives of the Nuffield A-level chemistry course, and assessment techniques and examined how examination performance can be used to monitor curriculum design. A report will be published later in 1975.

18 years 1970–73

J. C. Mathews, Department of Educational Research, University of Lancaster, Cartmel College, Bailrigg, Lancaster

A further number of Council projects that are primarily concerned with other subjects also contain elements of science. Readers are referred especially to the additional free leaflets in this series:
Schools Council: curriculum research and development in mathematics
Schools Council: curriculum research and development in humanities
Schools Council: curriculum research and development in environmental education

A SELECTED SCHOOLS COUNCIL BIBLIOGRAPHY

Examinations Bulletins

8 *The Certificate of Secondary Education : experimental examinations – science* HMSO 1965 15p (17½p)

15 *Teachers' experience of school-based examining (English and physics)* HMSO 1967 20p (24½p)

19 *CSE: practical work in science* SBN 423 43010 6 Evans/Methuen Educational 1969 25p

21 *CSE: an experiment in the oral examining of chemistry* by P. Brown, P. J. Hitchman and G. D. Yeoman SBN 423 44820 X Evans/Methuen Educational 1971 70p

Details of *Oral Examination in Science*, a videotape-recording of oral tests used in the experiment in this bulletin, from G. Nordhoff, Director of Television, Brunel University, Kingston Lane, Uxbridge, Middlesex.

26 *Engineering drawing at GCE A-level* SBN 423 87640 6 Evans/Methuen Educational 1972 80p

27 *Assessment of attainment in sixth-form science* SBN 423 88130 2 Evans/Methuen Educational 1973 65p

Working Papers

1 *Science for the young school leaver* 1965 free from Schools Council

4 *Science in the sixth form* HMSO 1966 22½p (27p)

26 *Education through the use of materials: the possible role of school workshops in the education of secondary-school pupils* SBN 423 43990 1 Evans/Methuen Educational 1969 25p

38 *Support for school science and technology* SBN 423 46510 4 Evans/Methuen Educational 1971 40p

Field Reports

5 *Science in the primary school* 1966 free from Schools Council

Curriculum Bulletins

2 *A school approach to technology* HMSO 1967 32½p (40p)

3 *Changes in school science teaching* SBN 423 87270 2 Evans/Methuen Educational 1970 33p

Recent articles in *Dialogue*

17 'Problem-solving and design' by Peter Stevenson (Design and Craft Education Project)

18 'The Influence of Science 5–13' by Shirley Toulson

Committee for Wales Publications

Science Bulletins 4 and *5* are available free from Committee for Wales. Most articles in these bulletins are in English; some are in Welsh.

Notes

For titles published by HMSO (–1969) and new editions of these, order through any bookseller or direct by post from HMSO, PO Box 569, London SE1 9NH (prices in brackets include postage). In the US Information on Schools Council titles published by HMSO is available from Pendragon House Inc., 1093 Charter Avenue, Redwood City, California 94063.

For titles published by Evans/Methuen Educational (1969–) orders, including standing orders, should be placed with bookshops or suppliers. In case of difficulty contact Sales Department, Evans/Methuen Educational, 11 New Fetter Lane, London EC4P 4EE. Evans/Methuen Educational titles are distributed in the US by Citation Press, Scholastic Magazines Inc., 50 West 44th Street, New York, NY 10036 and in Canada by Scholastic-TAB Publications Ltd, 123 Newkirk Road, Richmond Hill, Ontario.

Only requests for the free material should be sent to Information Centre, Schools Council, 160 Great Portland Street, London W1N 6LL. Requests for Committee for Wales publications available free should be sent to Schools Council Committee for Wales, 129 Cathedral Road, Cardiff CF1 9SX.

DIALOGUE

Subscriptions 24p for three issues (55p outside UK) to Information Section, Schools Council, 160 Great Portland Street, London W1N 6LL.